

RoadTalk

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PDDC System and Automated Pavement Surveys

Advancing Pavement Assessment



A vehicle outfitted with sensor-based pavement distress data collection technology.

Pavement condition surveys are integral to MTO's highway rehabilitation and management program. The ministry recently implemented Pavement Distress Data Collection (PDDC) software to enhance the efficiency of manual pavement condition assessments throughout the province. In an effort to improve the future assessment program, MTO is also conducting a research project with the University of Waterloo to investigate the possibility of automating pavement condition surveys.

Traditionally, pavement condition surveys are conducted manually by Pavement Design and Evaluation Officers (PDEOs) in every MTO region. While PDEO assessments are reliable, they tend to be subjective, tedious, and time consuming;

they also require the ministry to hold periodic information sessions to ensure uniform assessments across the province. MTO's new PDDC technology and automated condition investigation share a common goal: enhance the speed, objectivity, and accuracy of pavement surveys.

The new PDDC software, developed by MTO's I&IT group, is an application that runs on the PDEO's laptop during field inspections. The PDDC program is designed to integrate comprehensive data for various pavement distresses; these include severity and density measures, historical maintenance records, and calculations of overall distress conditions. This data is fed into MTO's Second Generation Pavement Management System (PMS2), an application used to manage information about the

provincial pavement network, plan rehabilitation projects, and coordinate investment decisions.

Fully implemented across the province in May 2005, the new PDDC offers many advantages over the previous Pavement Condition Rating (PCR) program including: improved data accuracy, a user-friendly electronic input, and a direct link to PMS2 that enables data importing and exporting. The software also offers immediate data retrieval from PMS2 (i.e. if a PDEO wishes to download and refer to the previous evaluation of a pavement section), multiple navigation and data search options, standardized evaluation measures and distress ratings, and the ability to generate reports for a single pavement section or a group of sections. The implementation of this new

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Readers are encouraged to submit articles, news items and comments to Kristin MacIntosh, Editor, at:

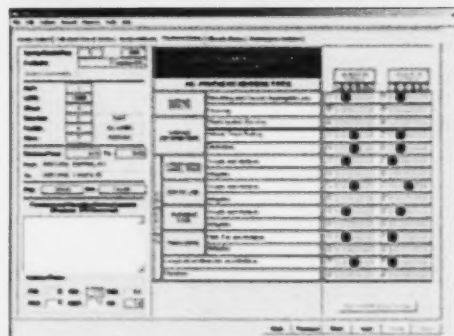
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TOP: Image-based technology collects pavement distress data using photography, videotape, and digital imaging.

MIDDLE: The new PDDC system details the type and severity of pavement distresses for specific highway sections.

BOTTOM: Sensor-based technology uses laser, acoustic, or infrared sensors to scan the road surface and record pavement distresses.

PDDC software has noticeably enhanced the efficiency and reliability of current pavement distress investigations.

MTO currently collects pavement performance data for rut depth, roughness, and cross section profile using the Automatic Road Analyzer (ARAN®) equipped vehicle. In an effort to enhance these existing technologies, MTO launched a research project in 2004 to investigate the feasibility of incorporating automated pave-

ment distress surveys. The project is being conducted in collaboration with the University of Waterloo's Centre for Pavement and Transportation Technology and three major Canadian pavement-engineering consultants. The technology used in this study has the potential to improve pavement assessments by replacing slow, subjective manual investigations with high-speed automated surveys.

The project is currently in its initial data collection phase; 37 pavement sections throughout Southern Ontario were selected for evaluation using sensor and image-based technologies. The selected sites represent concrete, asphalt, composite, and surface treated sections. The sensor-based technology collects road profile data using instrumented vehicles fitted with accelerometers and laser, acoustic, or infrared sensors. Image-based technology uses photography, videotape, and digital imaging to collect pavement data. The participating consulting companies applied both technologies to a one-kilometre stretch of pavement at each site to identify specific types of pavement distresses (i.e. longitudinal and transverse cracking, potholes, etc). Consistent standards for data collection were maintained because each company used similar equipment and algorithms to calculate results. An innovative data warehousing approach was used to allow for efficient data manipulation.

Though this technology requires further analysis, the preliminary results show a great deal of promise. Once the automated collection results are finalised, they will be compared to the results of manual inspections conducted by MTO staff. If the results exhibit an acceptable level of similarity, MTO may develop procedures and guidelines for the implementation of automated PDDC technologies. The project is scheduled for completion in March 2006.

The ministry is working to enhance both current and future pavement assessment practices. The recently implemented PDDC software has successfully improved the efficiency and reliability of manual pavement surveys, while MTO's joint project with the University of Waterloo attempts to carry pavement investigations into the next generation with fully automated assessment technologies. Stay tuned to Road Talk for future reports regarding the use of the new PDDC software and the final results of the automated data collection research project. •

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Environmentally Safe Paint Removal Trials

Say Goodbye to Graffiti

MTO strives for two primary goals in its maintenance and repair operations: provide the best possible results for the Ontario public, and make use of resources in a way that ensures the safety of workers and the preservation of the natural environment. In an effort to pursue these goals, the ministry recently conducted a trial in Eastern Region to evaluate a promising new paint removal technology.

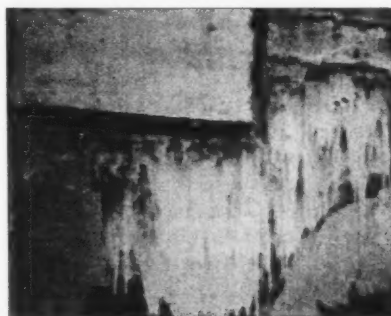
MTO typically uses sand blasting or soda blasting to remove paint or graffiti from overpasses, bridges, and other highway structures. Both methods involve the high-pressure application of sand or sodium bicarbonate to the surface of a structure to wear away or break down paint coatings or markings. While these methods are effective, they also feature some noteworthy disadvantages. Sand blasting is not environmentally friendly, as it requires significant cleaning of the area beforehand. Workers must wear protective equipment when using this method, and the sand must be removed following application, resulting in added costs. While soda blasting is more environmentally sound, it still requires workers to use protective equipment.

In the course of researching alternate graffiti removal options, MTO's Structural Section learned of a promising new removal material: Imperial Chemical Industries' Hydrostrip™ 502 Paint Stripper.

Hydrostrip 502 is a biodegradable, water-based emulsion/foam material that is both environmentally safe and worker-friendly. Paint strippers typically contain methylene-chloride, a carcinogen that poses significant danger to the environment; the Hydrostrip product does not use this chemical. The material is spray-applied or coated onto a surface (requiring no additional protective equipment), and is easily removed with high-pressure water following an appropriate sitting period. Hydrostrip requires minimal set-up and clean-up time, and is

readily available from most paint distributors. This non-toxic, low-odour product can be used to remove paint from a variety of structures (i.e. steel, concrete, wood, alloys), restoring the original condition of the surface without causing any of the physical damages that can result from the use of blast methods (i.e. surface discoloration, removal of surface fines pock marks). Structural Section arranged a trial use of this material to evaluate its potential to improve

BEFORE



AFTER



TOP: The Hydrostrip product was applied to graffiti on the Joyceville underpass. The material was left on the surface for one hour to penetrate the paint markings.

BOTTOM: The surface of the Joyceville Road underpass after the removal of the Hydrostrip product.

paint removal projects throughout Ontario. The trial occurred in June 2005 on two structures with significant graffiti markings, the John E. Scott and Joyceville Road underpasses, located near Kingston on Highway 401. The contractor coated the graffiti markings with a thick layer of the Hydrostrip product, allowed it to penetrate into the paint material for one hour, and then power washed it from the surface. The results were highly favourable: the product successfully removed the majority of paint markings, with only minor concrete stains remaining.

The product displayed no noteworthy drawbacks, and proved itself to be as effective as the blast methods currently used. As Hydrostrip can be applied to a variety of surfaces, it offers great versatility of use to the ministry. Due to its easy application and removal processes, it is clearly a cost-efficient alternative.

"The ministry's trial use of the Hydrostrip product was very successful," said Contract Administrator Andrea Lampman of McIntosh Perry Consulting Engineers Ltd. "This material can restore structures to conditions that will bring pride to those who travel our provincial highways."

"This material can restore structures to conditions that will bring pride to those who travel our provincial highways."

- Andrea Lampman

Contract Administrator,
McIntosh Perry Consulting Engineers Ltd

Following a positive recommendation from the Contracts Office, the ministry is currently considering further uses of the Hydrostrip product. Due to the proven results, cost savings, and environmentally safe features offered by this material, it remains a beneficial option available to the ministry and other transportation agencies for future graffiti and paint removal projects. •

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**MTO's Road
Recycling Efforts**

Responsible Road Building



Full depth reclamation with expanded asphalt is an effective rehabilitation technique that conserves valuable road materials.



Hot in-place recycling is an innovative rehabilitation method that allows for the complete re-use of existing resources.

For more information, contact
Chris Rogers, Soils and Aggregates
Section, at (416) 235-3734, or at
Chris.Rogers@mto.gov.on.ca

MTTO's recycling initiatives provide a model for other transportation agencies regarding the sustainable use of non-renewable road resources. In the course of daily maintenance and construction operations, the ministry employs recycling policies that produce high quality work in the present while conserving resources for future generations. MTO has been a leader in the field of aggregate recycling since the early 1980's. In the last four years, more than 9.8 million tonnes of road building aggregates (i.e. sand, gravel, stone) used by the ministry originated from recycled or recovered material, constituting almost 20% of the total tonnage of aggregates used. Ministry specifications allow for the use of reclaimed aggregates, reclaimed concrete material, reclaimed asphalt pavement, and industrial by-products (i.e. crushed glass, ceramics, blast furnace slag) in granular base and sub-base aggregates. The use of these materials in aggregate mixes provides a successful compromise between quality road performance and resource conservation. By making regular use of marginal aggregates, the ministry is able to reserve the use of high quality aggregates for areas where this material is in short supply. The blending of hot mix aggregates also enables the use of lesser quality materials as a component of the mixture; it is only necessary that the overall blend satisfy quality standards. Additionally, MTO has developed and implemented the Micro-Deval Abrasion and Freeze-Thaw tests to obtain more accurate assessments of aggregate quality. The American Association of State Highway and Transportation Officials, the Canadian Standards Association, and the American Association for Testing and Materials have recognized and adopted these successful test methods.

The ministry is currently planning a trial to evaluate the use of finely ground rubber from discarded tires as an asphalt pavement aggregate. This "wet process" trial, if successful, will enhance recycling efforts by enabling the re-use of a widely available, non-renewable material. MTO currently allows the limited use of another non-renewable material, waste/post-consumer glass, in crushed gravel and rock for the granular and sub-base of roads. Test sections have been established in Durham and Toronto to observe and explore the full potential of this resource as an aggregate material.

For more than 20 years, MTO has allowed the use of industrial by-products, blast furnace slag and fly ash, as partial replacements for Portland cement in concrete mixes. Blast furnace slag (a by-product of iron production) and fly ash (a fine residue resulting from industrial combustion) are waste materials that actively benefit concrete mixes by improving workability, reducing segregation, inhibiting alkali-aggregate reactions, and enhancing sulphate resistance. Both of these materials are used widely throughout the province, significantly reducing the emission of greenhouse gasses by one tonne for every tonne of slag or fly ash used as a substitute material.

In recent years, the ministry has implemented two innovative pavement-recycling methods that have considerably improved rehabilitation projects. The first method, Hot In-Place Pavement Recycling (HIR - see Road Talk, Nov.2003), is a process in which the pavement surface is heated and scarified, blended with rejuvenators and hot mix, then re-laid. The second method, Cold In-Place Recycling (CIR - see Road Talk, Nov.2003), involves a similar process: equipment grinds and processes an existing asphalt pavement, mixes in emulsion materials or expanded asphalt, then lays it down again. Both methods save a great deal of energy compared to the use of conventional hot mix asphalt, and they allow for the complete re-use of existing road materials to treat surface distresses and improve the pavement ride. CIR offers the added advantage of decreasing the use of fossil fuels and decreasing air pollution, as heating is not required.

Lastly, the ministry also makes use of full depth reclamation with expanded asphalt stabilization, a rehabilitation technique for severely damaged pavements. Using this process, the existing pavement is reclaimed in-place, and the base material is then stabilized with expanded asphalt mix. This relatively new road base recycling method increases the strength of pavement and allows for a thinner overlay, while reusing existing materials and conserving aggregate and asphalt cement.

MTO's road-recycling efforts serve the public of today while preserving valuable resources for the world of tomorrow. As a foremost leader in environmentally conscious resource use, MTO offers a positive model for realistic conservation practices to transportation agencies worldwide. •

In recent years, MTO has implemented a number of innovative asphalt pavement technologies to improve the quality and service life of Ontario's highways (see Road Talk June 2003, November 2003). In continuation of this effort, the ministry's Materials Engineering and Research Office (MERO) is currently reviewing different strategies to enhance the sustainability of hot-mix asphalt (HMA) pavements in Ontario.

Sustainable development is an infrastructure planning method that seeks to meet the needs of the present, while also protecting resources and considering the environmental impacts of work done for future generations. MERO recently conducted a study regarding the current standards and practices of the HMA industry in Ontario and other jurisdictions; this led the ministry to develop proposals to improve asphalt sustainability throughout the province. These proposals have the potential to conserve valuable resources and reduce the environmental impact of pavement construction projects. This article summarizes the major recommendations.

One of MTO's key strategies is to increase the re-use of existing road materials. The ministry currently uses several innovative techniques to repair Ontario highways; cold in-place recycling, hot in-place recycling, full-depth reclamation, expanded asphalt stabilization, and cold in-place expanded asphalt are used to rehabilitate asphalt pavements by treating and reprocessing the existing surface. These techniques conserve aggregates and reduce the emission of greenhouse gases by allowing for the complete re-use of non-renewable resources. It is proposed that these methods and future techniques be adopted, whenever technically feasible, throughout the province. It is recommended that guidelines are developed to aid pavement designers (provincial and municipal) in the selection and appropriate application of each technique. These methods support a "zero waste" approach to pavement rehabilitation - because the existing road material is reprocessed, no resources are wasted and additional pavement materials are minimized.

The use of perpetual pavement is another asphalt sustainability strategy. Perpetual pavement is an innovative hot

mix pavement structure that is specially designed to last longer than conventional HMA pavement. The ministry is currently constructing perpetual pavement trials; if results are positive, perpetual pavement will be used to build or rehabilitate heavily trafficked roadways.

The ministry uses a Life Cycle Costing (LCC) methodology on the majority of asphalt pavement projects. LCC involves a comprehensive analysis of construction, maintenance, and rehabilitation costs of conventional pavement alternatives along with innovative sustainable technologies to assist in the selection of the most cost-effective long-term pavement design.

Yet another strategy involves MTO serving in an advisory capacity to the Ministry of Natural Resources and municipalities to develop a broader provincial framework for the conservation of aggregate resources. There are several groups within MTO working to ensure Ontario's roadways are environmentally sustainable. Work will continue in the areas of transportation planning, highway design, construction, operations and maintenance to consider different options to ensure that all pavements are constructed and maintained using the maximum percentage of recycled materials.

Additional strategies considered in the study include: the revision of Ontario Provincial Standards to encourage the greater use of recycled asphalt pavement in Superpave mixes; the provincial and municipal adoption of "zero waste" concepts on appropriate pavement projects; and stricter environmental regulations.

The recommendations outlined in this article are designed to conserve non-renewable resources, protect the natural environment, and ensure the long-term safety and reliability of provincial roadways. These sustainability strategies are currently being assessed and finalised by the ministry; stay tuned to Road Talk for future progress reports. •

MTO's Strategies for Asphalt Sustainability

Looking to the Future



Reprocessing roadway surface to reduce existing non-renewable pavement materials.



Hot in-place recycling, another sustainable paving option.

For more information on the study, contact Pamela Marks, at (416) 235-3724, or at Pamela.Marks@mto.gov.on.ca and on LCC methodology or the various innovative technologies contact Becca Lane, at (416) 235-3513, or at Becca.Lane@mto.gov.on.ca

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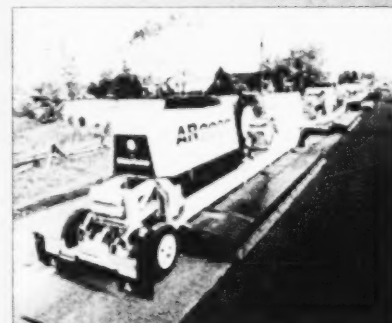
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MTO's Engineering Materials Management System

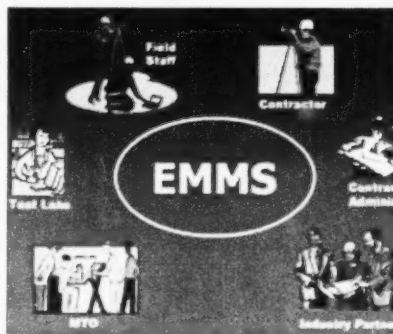
Maximizing Information Management

Ontario has one of the largest transportation systems in the world, featuring over 16,500km of highway with 2500 bridges and structures. MTO is planning to implement several powerful new software solutions to aid the operation and maintenance of this massive transportation network. One of these applications is the Engineering Materials Management System (EMMS).

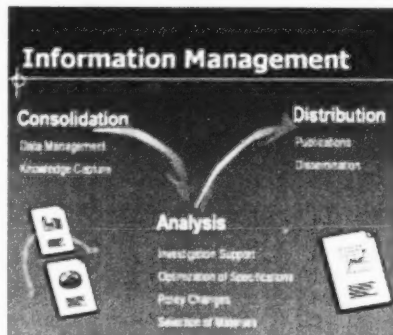
The ministry conducts more than 70,000 acceptance tests each year to verify the quality of construction work and materials, and to determine appropriate payment adjustments. Though the ministry has achieved great success, serious complications exist within the current process used to manage valuable materials related data. The data collected from acceptance tests is not readily accessible, and cannot be fully utilized on active construction contracts or when developing new projects or specifications. The current process for collecting and reporting acceptance test results is cumbersome, involving paper forms, email, and numerous spreadsheets. Furthermore, the collection process is inconsistent, varying across regions and construction contracts. As it stands, the current data collection process does not satisfy MTO's requirements for comprehensive, integrated, and accurate historical data. This is a key issue, as the ministry relies on this information to assess the work performed by contractors, the quality of testing conducted by contracted laboratories, and the effectiveness of current construction specifications.

In an effort to correct these deficiencies, the ministry is investigating EMMS, a materials management software program that will streamline the data collection process and provide comprehensive, reliable, and shareable results. While many American departments of transportation have incorporated this software into their operations, this technology remains relatively new to Canada.

EMMS is an electronic system that will allow for the efficient collection, management, and distribution of acceptance test results for construction projects across the province. Using EMMS, test results will be entered directly into a central data location by MTO professionals or contracted laboratories. This data will then be organized and processed to provide reliable information about engineering materials.



The individuals and organizations involved in the development and use of the MTO's Engineering Materials Management System.



The process and elements of information management. EMMS will play an integral role in supporting this process.

The system will feature three levels of data:

- 1) **Temporary data:** Data entered into the system by contracted labs.
- 2) **Permanent storage:** Finalised results that have been approved by a contract administrator. This data is stored and can be accessed by MTO staff.
- 3) **Shared information:** Comprehensive data that is made available to the industry.

EMMS offers many advantages: by automating the tracking, submission, and analysis of test results, the system will eliminate paper-based data collection and improve MTO's ability to monitor the quality of materials and construction

processes. The software is web-based, enabling efficient data sharing and transmission; it will provide an integrated, comprehensive source of historical data that can be used for planning and testing activities, and to develop new construction standards and specifications. Also, the system will integrate GPS technology to record location information.

Many key benefits will result from integrating EMMS into MTO's engineering practices. The information provided by the system will improve contract administrators' ability to manage the quality of materials and construction work. EMMS will support strategic operations, as it will supplement many of the ministry's decision support tools (i.e. bridge and pavement management systems), allowing users to "drill down" for detailed information on specific sets of data. The flexible EMMS platform is compatible with new technologies that may enhance the efficiency and integrity of the materials management process, including Radio Frequency Identification devices, alternate input devices (i.e. handheld PC), and speech recognition software. EMMS will seamlessly integrate acceptance test results with related information (i.e. mix designs, quantities) in a single, readily shareable database; this will provide easily accessible, accurate data that the ministry can use to make informed decisions regarding construction designs and materials. The system also has the potential to lower maintenance costs and increase the longevity of assets, because the data it provides will help identify and resolve construction and materials problems.

MTO is currently investigating and preparing to acquire a commercial EMMS software package. The ministry will likely opt to purchase and customize a materials management system rather than create one from scratch, as it would produce lower costs and risks, increased flexibility, and faster implementation. Once a suitable system is selected, implementation activities will begin. The plan is for EMMS to be in operation in 2007. Stay tuned to future issues of Road Talk for updates on the progress of this promising new technology. •

For more information, contact
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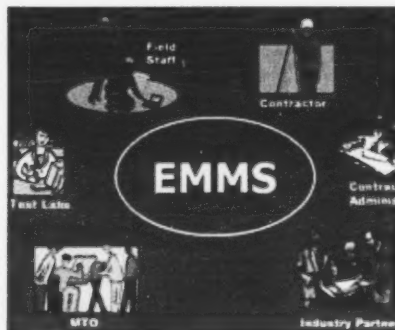
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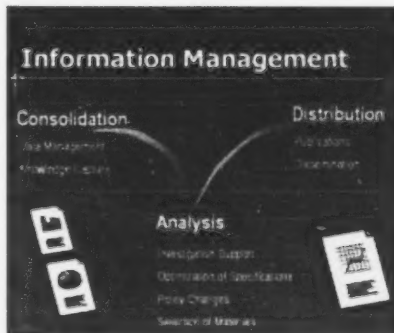
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Eagleson Road Interchange VE Study

The Value of Dynamic Design

Value Engineering (VE) is a systematic approach to analysis and design that is used to improve the value of products, projects, and processes. Over the years, MTO has used VE on select projects to maximize the efficiency and cost-effectiveness of its transportation initiatives (See Road Talk, August 2003, February 2004, Spring 2005). MTO's latest VE success story involves the collaborative design of several options for the expansion and upgrade of the Highway 17/Eagleson Road interchange in Kanata.

The Highway 417/Eagleson Road interchange serves both the Kanata Town Centre and the large industrial sector to the north. Expected growth over the next 20 years will place heavy demands on the traffic capacity of the interchange and the adjacent arterial road network.

A Value Engineering workshop was held from March 29 to April 2, 2004, to review the preliminary design for the future upgrade of the interchange. Led by Steven Taylor of National Capital Engineering, 15 interdisciplinary specialists generated 115 ideas for the expansion of the interchange; these ideas were then screened down to 27 proposals for new interchange configurations, modifications to existing alternatives, or general ideas for improvement. Key stakeholders, including the City of Ottawa, OC Transpo (Ottawa public transit), and the National Capital Commission (NCC), actively participated in the study.

Several challenges and issues guided the study. The interchange is situated on a deep pocket of sensitive clay soil between the built-up Kanata Town Centre and NCC Greenbelt lands, with Campeau Drive connecting across from the north ramp terminal (currently the fourth-worst intersection for collisions in the city) and a major Park-n-Ride transit facility across from the south ramp terminal. Traffic movements forecast for the interchange are very high, and will require double ramps to and from the east on Highway 417.

The project team developed a series of modifications to the initial design

FIGURE 1. The project team's modifications to the proposed redesign of the Highway 417/Eagleson Road Interchange.



(see Figure 1), which resulted in a 25% improvement in performance, with a 20% reduction in cost. Additionally, the recommended alternative can be expanded in the future by twinning structures and adding additional ramps to provide further capacity in the event of a high-growth scenario.

Other alternatives were recommended for further consideration, providing innovative proposals for the redistribution of traffic on the arterial road network. The future location of the proposed transitway and the possible relocation of the Park-n-Ride facility were identified as important issues for further discussion with the City of Ottawa.

The highest rated alternative, illustrated in Figure 2, proposed a smaller footprint for the interchange by increasing the structure length, twinning the existing Eagleson Road structure, and grade separating the Campeau Drive intersection. This option will include a continuous north service road, allowing the city to utilize the capacity of Corkstown Road, and a pedestrian grade separation at the south ramp terminal. This alternative increased the performance of the original design by 65% with the same approximate capital cost.

"I am very pleased with the results of the study," said Keith Dustin, MTO Project Engineer. "The team produced many promising concepts and modifications that will prove valuable to the development of the interchange."

The VE process, through an interactive team approach, produced alternative designs that will assist the future planning of the interchange and allow for the implementation of the solution that provides the best value for the province. •

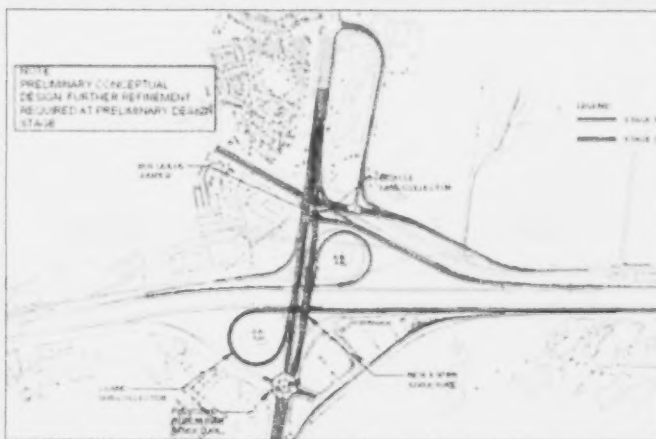


FIGURE 2. An alternative design for the interchange that offers significant performance advantages over the original design.

For more information, contact David Kerr, Engineering Office, at (613) 545-4832, or at David.Kerr@mto.gov.on.ca or Keith Dustin, Planning and Design Office, at (613) 545-4743, or at Keith.Dustin@mto.gov.on.ca.

Read All About It!

Joseph Ponniah: MTO's "Reverse Co-op"



Joseph Ponniah uses Interlaken laboratory testing equipment to conduct a newly developed test for evaluating tack coat at the University of Waterloo's Centre for Pavement and Transportation Technology.

As our province grows and strives to develop a safe and efficient transportation system, investments in human and capital resources are needed to explore new ideas, address existing concerns, and chart innovative ground in the transportation field. Recognizing this need, two years ago MTO signed a partnership agreement with the University of Waterloo to participate in UW's Centre for Pavement and Transportation Technology (CPATT) with in-kind support. As part of the in-kind contribution,

Joseph Ponniah, Senior Pavement Research Engineer from MTO joined the University of Waterloo in the fall of 2003, as manager, liaison and research professor. As part of his "reverse co-op placement" Joseph acts as a liaison person between MTO and Waterloo, represents MTO's interests at CPATT and works with the other partners to provide a knowledge base and new products and technology for better building highways. Two years after his arrival at CPATT, Ponniah is currently conducting research in a variety of exciting transportation technology areas. For example, right now Ponniah is researching the development of seismic-wave based non-destructive test methods for evaluating asphalt pavement. In addition, he is researching the impacts on pavements due to vehicle weight dimensions reforms. Furthermore, Ponniah is researching the development of an adhesion test for evaluating tack coat as well as the validation of perpetual pavement design concepts. When asked about the benefits of his "reverse co-op" at CPATT Ponniah said, "By becoming a partner of CPATT, MTO sends a message that innovation and excellence is not simply expected but encouraged. It demonstrates MTO's strong commitment to support research for developing innovative solutions to address complex transportation issues in Ontario." •

For more information on this article, contact Dr. Joseph Ponniah, at (519) 888-4567 ext. 3725, or at jeponnia@sunburn.uwaterloo.ca.

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